

REMARKS

I. Introduction

By the present Amendment, claims 1, 7, 9, and 10-21 have been amended. No claims have been added or cancelled. Accordingly, claims 1 and 3-21 remain pending in the application. Claims 1 and 21 are independent.

II. Office Action Summary

In the Office Action of August 6, 2010, claims 9-21 were provisionally rejected on the ground of non-statutory obviousness double patenting as being unpatentable over claims 1-10 and 12-14 of co-pending application No. 11/577,005; claims 1-8, 10-13, 15, and 16 of co-pending application 11/577,334; claims 1 and 8 of co-pending application No. 11/913,959; and claims 1-18 of co-pending application No. 11/571,782. Claims 1 and 3-21 were rejected under 35 USC §112, first paragraph. Claims 7 and 9-21 were rejected under 35 USC §112, second paragraph, as being indefinite. Claims 1 and 3-21 were rejected under 35 USC §102(b) as being anticipated by U.S. Patent No. 6,381,197 issued to Savord et al. ("Savord"). These rejections are respectfully traversed.

III. Double Patenting Rejections

Claims 9-21 were provisionally rejected on the ground of non-statutory obviousness type double patenting as being unpatentable over either (1) claims 1-10 and 12-14 of co-pending application No. 11/577,005, (2) claims 1-8, 10-13, 15, and 16 of co-pending application No. 11/577,334, (3) claims 1 and 8 of co-pending application No. 11/913,959, or (4) claims 1-18 of co-pending application No. 11/571,782.

Since these rejections are provisional, Applicants elect to wait until the claims of either the instant application or the conflicting applications have been allowed, or indicated as allowable, in order to provide a response most appropriate to issued claims.

IV. Rejections under 35 USC §112

Claims 1 and 3-21 were rejected under 35 USC §112, first paragraph, as failing to comply with the written description requirement. Regarding this rejection, the Office Action alleges that the claims contain subject matter which was not described in the Specification in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the invention at the time the application was filed. The Office Action goes on to allege that the Specification and Figures recite the term "means" without providing examples of what structure is defined by the elements that contain this term.

At the outset, Applicants note that the Specification does, in fact, provide examples of the structures defined by elements containing the term means. Where specific structures are not defined, a skilled artisan would easily understand how to practice the invention without further description. Nonetheless, it appears that the Office Action is attempting to force Applicants to change the language of the claims in order to advance prosecution of the application. Accordingly, Applicants have made numerous amendments to the claims in order to remove most occurrences of the word "means".

Applicants respectfully submit that the presently pending claims satisfy the written description requirement. Withdrawal of this rejection is therefore respectfully requested.

Claims 7 and 9-21 were rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter regarded as the invention. Regarding this rejection, the Office Action indicates that Applicants assert that various claim elements are means plus function limitations that invoke 35 USC §112, sixth paragraph. In a somewhat contradictory statement, however, the Office Action goes on to state that it is unclear whether these claim elements are means plus function limitations that invoke 35 USC §112, sixth paragraph, because the claims are modified by various structures.

By the present Amendment, Applicants have amended the claims to remove the means plus language in an attempt to satisfy the Examiner's requirements. To the extent that the Examiner feels that additional amendments are necessary, Applicants welcome any suggestions that would be acceptable by the Examiner.

Based on the foregoing, withdrawal of this rejection is therefore respectfully requested.

V. Rejections under 35 USC §102

Claims 1 and 3-21 were rejected under 35 USC §102(b) as being anticipated by Savord. Regarding this rejection, the Office Action alleges that Savord discloses a plurality of transducers for transmission and reception of ultrasonic waves, where it is inherent in the semiconductor silicon oscillation elements (MUT elements) has the characteristic of changing the electromechanical coupling coefficient in accordance with the strength of the direct-current bias. The Office Action goes on to allege that Savord discloses a plurality of the oscillation elements of equal number being divided into a plurality of groups with equal intervals in a minor and major axis direction that are commonly connected, the distance between each MUT element being varied for

purposes such as aperture control, and the gain of each MUT element being varied to produce a different bias for each group for the purpose of apodization and elevation/image depth control. The Office Action goes on to indicate that Savord discloses a terminal with a distribution means that is connected to system electronics for control and bias purposes which includes a switching means for selectively applying a bias when ultrasonic waves are transmitted and received. Applicants respectfully disagree.

At the outset, Applicants note that a proper case of anticipation has not been made in the Office Action. In order to support a rejection under 35 U.S.C. §102, the burden falls on the Examiner to establish a *prima facie* case of anticipation. See *In re Sun*, 31 USPQ2d 1451, 1453 (Fed. Cir. 1993). As emphasized by the court in *In re Warner*, “[t]he precise language of 35 U.S.C. 102 that “a person shall be entitled to a patent unless,” concerning novelty and unobviousness, clearly places a burden of proof on the Patent Office which requires it to produce the factual basis for its rejection of an application under sections 102 and 103. . . .” (Emphasis added) 154 USPQ 173, 177 (C.C.P.A. 1967), *cert. denied*, 389 U.S. 1057 (1968).

In order to qualify as an anticipatory reference, a prior art reference must necessarily disclose each and every element recited in the claimed invention. This disclosure must also be made with a sufficient level of clarity. See *Motorola, Inc. v. Interdigital Tech. Corp.*, 121 F.3d 1461, 43 USPQ2d 1481, 1490 (Fed. Cir. 1997). See also *In re Spada*, 911 F.2d 705, 708, 15 USPQ2d 1655, 1657 (Fed. Cir. 1990) (“[T]he [prior art] reference must describe the applicant’s claimed invention sufficiently to have placed a person of ordinary skill in the field of the invention in possession of it.” (citations omitted)). As further stated by the Federal Circuit, “Although this disclosure requirement presupposes the knowledge of one skilled in

the art of the claimed invention, that presumed knowledge does not grant a license to read into the prior art reference teachings that are not there." (Emphasis added)

Id.

Reference is further made to the decision of *In re Robertson*, 49 USPQ 2d 1949 (Fed. Cir. 1999), wherein the court pointed out that anticipation under 35 U.S.C. §102 requires that each and every element as set forth in the claim be found, either expressly or inherently described in a single prior art reference. As noted by that court, if the prior art reference does not expressly set forth a particular element of the claim, that reference still may anticipate if the element is "inherent" in its disclosure. To establish inherency, the extrinsic evidence "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." (Emphasis added). Moreover, the court pointed out that inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. See also *In re Oelrich*, 666 F.2d 578, 581, 212 USPQ 323, 326 (C.C.P.A. 1981) ("Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient.")

Finally, the alleged anticipatory reference must be enabling. In particular, it is the claimed invention that must be enabled within the reference and not any other teachings disclosed by the reference. See *Elan Pharms. Inc. v. Mayo Found. for Med. Educ. & Research*, 346 F.3d 1051, 68 USPQ2d 1373, 1375-76 (Fed. Cir. 2003) ("To serve as an anticipating reference, the reference must enable that which it is asserted to anticipate."); and *Amgen, Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1354, 65 USPQ2d 1385, 1416 (Fed. Cir. 2003) ("A claimed invention cannot

be anticipated by a prior art reference if the allegedly anticipatory disclosures cited as prior art are not enabled.").

In the instant case, the application has completely neglected to address the limitation of the plurality of oscillation elements which were added to independent claim 1 in the previously filed Amendment. Consequently, the rejection would appear to be improper, as would the finality of the Office Action.

In any event, Applicants have amended the claims in order to better define the invention, and incorporate features that are not shown or suggested by the art of record. As amended, independent claim 1 defines an ultrasonic probe that includes a plurality of transducers in an array for converting drive signals into ultrasonic waves to transmit the waves in an object to be inspected. The waves are then converted into electrical signals to receive ultrasonic waves generated from the object. According to independent claim 1:

each of the transducers comprises a plurality of oscillation elements, each of the oscillation elements has a characteristic of changing an electromechanical coupling coefficient in accordance with strength of a direct-current bias applied by being superposed on the drive signal, and an electrode of each of the transducers is connected to a terminal provided with the drive signal,

the plurality of oscillation elements are divided into a plurality of groups including sections of the oscillation elements, and

a number of the sections pertaining to each of the divided groups change in accordance with a focal depth to which the direct-current bias is to be applied.

The ultrasonic probe of independent claim 1 includes transducers which each include a plurality of oscillation elements having a characteristic of changing an electromechanical coupling coefficient in accordance with the strength of a direct-current bias applied by being superposed on the drive signal. Each transducer also includes an electrode that is connected to a terminal provided with the drive signal.

The plurality of oscillation elements are divided into a plurality of groups that include sections of the oscillation elements. Furthermore, the number of sections pertaining to each of the divided groups changes in accordance with the focal depth to which the direct-current bias is to be applied.

As discussed in the Specification, the sound pressure distribution of the ultrasound beams can be controlled by changing the number of sections constituting a group of the oscillation elements. See paragraph [0071]. For example, consider a transducer element formed by a plurality of oscillation elements that are divided into seven sections (P1 to P7) in the minor axis direction. Three exemplary focal positions (A, B, C) can be set in the depth direction. See paragraph [0073]. When a reflection echo signal generated from a focal point (A) is received ($t = t_a$), sections P3 to P5 are selected by the bias means (14), and predetermined bias voltages are applied to the selected sections. Similarly, when a reflection echo signal generated from focal point B is received ($t = t_b$), the bias means selects sections P2 to P6 and applies a predetermined bias voltage to each selected section. See paragraph [0074]. According to independent claim 1, it therefore becomes possible to precisely control the sound pressure distribution in accordance with the focal depth by changing the number of sections and controlling the amount of bias voltage applied to each individual section. This makes it possible to effectively change the ultrasonic aperture for receiving the reflection echo signals with respect to the depth of the focal points. The results become equivalent to a case where a variable-aperture technique automatically reduces the size of the receiving aperture as the focal depth decreases. See paragraphs [0075] and [0076].

Contrary to the present invention, Savord does not control the sound pressure distribution in accordance with the focal depth by changing the number of sections.

Rather, Savord discloses that entire rows of MUT elements must be energized depending on whether a deep image or shallow image is desired. This is done completely irrespective of the focal depth. Savord specifically indicates that when switch 57 is in an open position, only MUT element 11A in transducer element row 54 is energized. Conversely, when switch 57 is closed, all three MUT elements 11A, 11B, and 11C in transducer element rows 52, 54, and 56 are respectively energized. Furthermore, all three transducer element rows are energized when a deep image is desired. If a shallow image is desired, then only transducer element row 54 is energized. See column 5, lines 37-60.

Despite changing the number of transducer element rows that are energized, it is still difficult to precisely shape the beam. According to Savord, a scan is started using a narrow beam (i.e., using only transducer element row 54). Once a predetermined depth of interest is reached, then the switch is used to activate all three transducer element rows (52, 54, and 56) in order to maximize the depth of interest. See column 6, lines 8-25. Savord appears to provide no disclosure or suggestion for features recited in independent claim 1, such as:

the plurality of oscillation elements are divided into a plurality of groups including sections of the oscillation elements, and

a number of the sections pertaining to each of the divided groups change in accordance with a focal depth to which the direct-current bias is to be applied.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 3-20 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim

1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

As amended, independent claim 21 defines a method for ultrasonic imaging that comprises:

applying a direct-current bias to a plurality of oscillation elements possessed by each transducer arrayed in an ultrasonic probe and changing an electromechanical coupling coefficient of each of the oscillation elements to a setting value;

supplying a drive signal to each of the oscillation elements by superposing the drive signal on the direct-current bias, transmitting an ultrasonic wave to an object to be inspected from each of the oscillation elements; and

receiving an ultrasonic wave generated by the object by each of the oscillation elements to convert the wave into an electrical signal and reconstructing an ultrasound image based on the converted electrical signal,

wherein the plurality of oscillation elements are divided into a plurality of groups including sections of the oscillation elements, and

wherein a number of the sections pertaining to each of the divided groups change in accordance with the focal depth to which the direct-current bias is to be applied.

According to the method of independent claim 21, a direct-current bias is applied to a plurality of oscillation elements in each transducer array in an ultrasonic probe and the electromechanical coupling coefficient of each of the oscillation elements is changed to a setting value. A drive signal is then supplied to each of the oscillation elements by superposing the drive signal on the direct-current bias, and an ultrasonic wave is transmitted to an object to be inspected from each of the oscillation elements. Ultrasonic waves generated by the object are received and converted to electrical signals so that an ultrasound image can be constructed based on the converted electrical signals. According to independent claim 21, the plurality of oscillation elements are divided into a plurality of groups including sections of the

oscillation elements, and a number of the sections pertaining to each of the divided groups change in accordance with the focal depth to which the direct-current bias is to be applied.

As previously discussed with respect to independent claim 1, Savord does not appear to provide any disclosure or suggestion for such features. It is therefore respectfully submitted that independent claim 21 is allowable over the art of record.

VI. Conclusion


For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 389.46065X00).

Respectfully submitted,
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